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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Naoto Oku et al.	Art Unit:	1635
Serial No.:	09/623,307	Examiner:	Epps, J.
Filed:	March 21, 2001	Customer No.:	21559

Title: COMPOSITION FOR TRANSPORTING NEGATIVELY CHARGED SUBSTANCES

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION OF NAOTO OKU UNDER 37 C.F.R. § 1.132 TRAVERSING GROUNDS OF REJECTION

Under 37 C.F.R. § 1.132 and regarding the rejection of claims 51, 52, and 57-63 for indefiniteness, I declare:

1. I am an inventor of the subject matter that is described and claimed in the above-captioned patent application.

2. I have been working in the field of polymer science for 18 years.

3. Commercially available polymers are typically produced as mixtures of individual polymers having varying numbers of monomer units. Because of this variation,

polymers are described by an average molecular weight. This value is typically rounded to the nearest 100, e.g., 600 or 1800.

4. The 1998-1999 Catalog Handbook of Fine Chemicals from Aldrich (Exhibit A) shows that polyethylenimine products are described by approximate average molecular weights. In particular, product 40,871-9 has an average molecular weight (M_n) of circa 600, and product 40,870-0 has an average molecular weight (M_n) of circa 1800.

5. All statements made herein of my own knowledge are true and all statements made on information and belief are believed to be true; and further these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under § 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patents issued thereon.

Oct 30, 2003
Date

Naoto Oku
Naoto Oku

Exhibit A

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the Success of Our Customers
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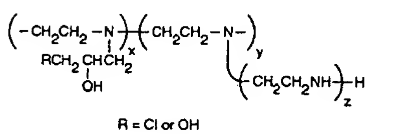
$

			$
40,871-9 ★	**Polyethylenimine,** low molecular weight, water-free [*25987-06-8*] ... $(-NHCH_2CH_2-)_x[-N(CH_2CH_2NH_2)CH_2CH_2-]_y$ n_D^{20} 1.5240 d 1.050 Fp >230°F(110°C) Average M_n *ca.* 600 (GPC). Average M_w *ca.* 800 (LS). Branched polymer	100mL 250mL 1L	25.25 45.45 110.05
40,872-7 ★	**Polyethylenimine,** high molecular weight, water-free [*9002-98-6*] ... $(-NHCH_2CH_2-)_x[-N(CH_2CH_2NH_2)CH_2CH_2-]_y$ n_D^{20} 1.5290 d 1.030 Fp >230°F(110°C) *SI* 501,D,1 *R&S* 1(2),3187D *RTECS#* TQ7700000 *IRRITANT* Average M_n *ca.* 10,000 (GPC). Average M_w *ca.* 25,000 (LS). Branched polymer	100mL 250mL 1L	27.05 48.00 119.90
48,259-5 NEW ★	**Polyethylenimine,** 50 wt. % solution in water [*25987-06-8*] ... $(-NHCH_2CH_2-)_x[-N(CH_2CH_2NH_2)CH_2CH_2-]_y$ n_D^{20} 1.4540 d 1.080 Fp >230°F(110°C) Average M_n *ca.* 1,200. Viscosity (25° C) 200-500 cps	100mL 250mL	19.00 31.00
40,870-0 ★	**Polyethylenimine,** low molecular weight, 50 wt. % solution in water [*25987-06-8*] $(-NHCH_2CH_2-)_x[-N(CH_2CH_2NH_2)CH_2CH_2-]_y$ Branched polymer. Average M_n *ca.* 1,800 (GPC). Average M_w *ca.* 2,000 (LS)	5mL 250mL 1L	13.25 29.55 82.15
18,197-8 ★	**Polyethylenimine,** 50 wt. % solution in water [*68130-97-2*] ... $(-NHCH_2CH_2-)_x[-N(CH_2CH_2NH_2)CH_2CH_2-]_y$ *SI* 501,D,1 *Safety* 2,2874B *R&S* 1(2),3187D *RTECS#* TQ7700000 *IRRITANT* Protein precipitant. *J. Biotechnol.* **1990,** *14,* 273. Viscous liquid. Average M_n *ca.* 60,000 (GPC). Average M_w *ca.* 750,000 (LS). Branched polymer	5g 100g 250g 18kg	10.15 18.85 31.25 319.20
24,674-3	**Polyethylenimine on silica gel,** beads, 20-60 mesh *HYGROSCOPIC* ... (*send for Bulletin AL-142*)	10mL 50mL	19.00 60.35
24,675-1	**Polyethylenimine on silica gel,** powder, 40-200 mesh *HYGROSCOPIC* ... Ion-exchange resin (*send for Bulletin AL-142*)	10mL 50mL	18.90 63.40
24,677-8	**Polyethylenimine on silica gel, benzylated,** beads, 20-40 mesh *HYGROSCOPIC* Useful for solid-phase organic synthesis, solid-phase sequencing of biopolymers, catalyst immobilization, and affinity chromatography. (*send for Bulletin AL-142*)	10mL	32.90
24,678-6	**Polyethylenimine on silica gel, benzylated,** powder, 40-200 mesh ... *HYGROSCOPIC* (*send for Bulletin AL-142*)	10mL	14.85
30,617-7	**Polyethylenimine, epichlorohydrin modified,** 17 wt. % solution in water d 1.055 Fp none *SI* 508,D,3 *R&S* 1(2),3187F Average M_w *ca.* 20,000. Viscosity 10-100 cps. pH 4-6	250g 500g	32.35 45.85
30,618-5 ★	**Polyethylenimine, 80% ethoxylated,** 37 wt. % solution in water [*26658-46-8*] ... d 1.080 Fp none *SI* 508,C,3 *R&S* 1(2),3187E *CORROSIVE* Base polymer average M_w *ca.* 50,000. pH 12	100g 250g	33.00 48.80
42,347-5 ★	**Polyethylenimine, 80% ethoxylated,** 35-40 wt. % solution in water [*26658-46-8*] Base polymer average M_w *ca.* 70,000. pH 12	50mL 250mL	19.50 47.55
46,426-0 NEW ★	**Poly(2-ethyl-1,3-hexanediol sebacate), bis(2-ethylhexyl) terminated** ... [*87227-64-3*] n_D^{20} 1.4580 d 0.948 Fp >230°F(110°C) Average M_n *ca.* 800. Viscosity (38°C) 52 cSt, (99°C) 9 cSt. Pour point <-60°F	50mL 250mL	15.00 50.00
18,206-0 ★	**Poly(2-ethylhexyl acrylate)** [*9003-77-4*] $(-CH_2CH[CO_2CH_2CH(C_2H_5)(CH_2)_3CH_3]-)_n$ .. d 0.903 Fp 40°F(4°C) *FT-IR* 1(2),1188D *SI* 502,C,3 *Safety* 2,2874C *FLAMMABLE LIQUID TOXIC* Solution in toluene. Unit weight does not include weight of solvent. Average M_w *ca.* 92,000 (GPC). Tg -55°	50g 100g	55.60 94.90



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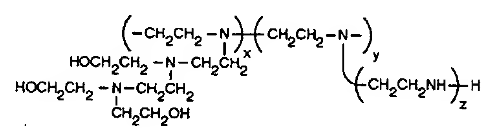

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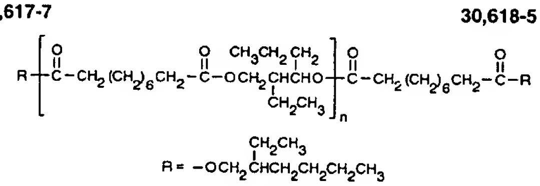

46,426-0

General Chemistry

FIFTH EDITION

Principles and Modern Applications

RALPH H. PETRUCCI

California State University, San Bernardino

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Water, ammonia, carbon monoxide, carbon dioxide, and sulfuric acid—these substances are familiar to almost everyone. All of them are rather simple chemical compounds. Only slightly less familiar are substances like vitamin C, chlorophyll, and sucrose. These, too, are chemical compounds.

Sucrose, which is ordinary cane sugar, consists of 42.10% C, 6.48% H, and 51.42% O. How can we establish this fact by experiment? Once we have determined this percentage composition, how can we use it to deduce the chemical formula of sucrose? And what types of information can we derive from a chemical formula? The aspect of chemistry that deals with these fundamental questions is called *stoichiometry,* which means, literally, to measure the elements (Gr., *stoicheion,* element).

We begin a study of stoichiometry in this chapter. Another practical matter that we will start to consider in this chapter is how to relate the names of chemical compounds to their formulas (referred to as chemical nomenclature).

3-1 Formulas, Formula Weights, and Molecular Weights

Chemical compounds are represented by combinations of symbols called chemical formulas. A **chemical formula** indicates

1. The elements present in a compound.
2. The relative numbers of atoms of each element in the compound.

In the following formula the elements are denoted by their symbols and the relative numbers of atoms by *subscript* numerals (where no subscript is written, the number 1 is understood).

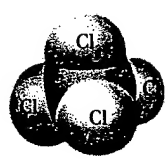

FIGURE 3-1
A molecule of CCl_4.

the two elements present

H_2O

two H atoms per formula unit

lack of subscript means one atom of O per formula unit

Here are three additional formulas.

CCl_4	NaCl	$MgCl_2$
carbon tetrachloride	sodium chloride	magnesium chloride

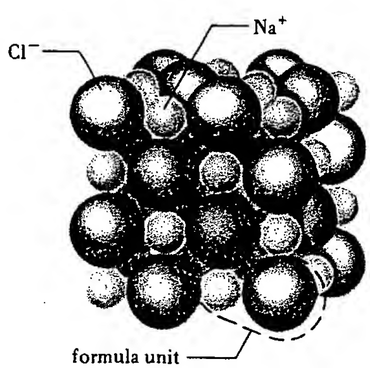

FIGURE 3-2
A formula unit of NaCl.

Sodium chloride consists of Na^+ and Cl^- ions in a very large network called a crystal. The combination of one Na^+ and one Cl^- ion, called a formula unit, is the smallest collection of ions from which we can deduce the formula NaCl.

The group of five atoms represented by the formula CCl_4 and pictured in Figure 3-1 is called a molecule. A **molecule** is a group of bonded atoms that actually exists as a separate entity. With sodium chloride, NaCl, we encounter a different situation. As shown in Figure 3-2, each Na^+ ion is surrounded by *six* Cl^- ions (and vice versa). We cannot say that any one of these six Cl^- ions belongs exclusively to a Na^+ ion, so we *arbitrarily* select a combination of one Na^+ ion and one Cl^- ion and call this a formula unit. A **formula unit** is the smallest collection of positive and negative ions from which we can derive the simplest formula (that is, the formula with the smallest subscripts). Because the formula unit NaCl is buried in a vast array of ions and cannot be obtained as a separate entity, we should not call it a molecule. The situation with $MgCl_2$ is similar to that of NaCl.

Formula Weight and Molecular Weight. Once we have identified a formula unit it is a simple matter to establish the formula weight of a compound. **Formula weight** is the mass of a formula unit relative to an assigned mass of 12.00000 for C-12. A more useful definition, though, is

Definition of formula weight.

Formula weight is the sum of the atomic weights of all the atoms in a formula unit. (3.1)

Thus, for sodium chloride, NaCl, whose formula unit consists of one Na^+ ion and one Cl^- ion,

formula weight NaCl = at. wt. Na + at. wt. Cl

$$= 22.99 + 35.45 = \mathbf{58.44}$$

And for magnesium chloride, $MgCl_2$,

formula weight $MgCl_2$ = at. wt. Mg + (2 × at. wt. Cl)

$$= 24.305 + (2 \times 35.453) = \mathbf{95.21}$$

If a compound consists of discrete molecules, we can also speak of a molecular weight. **Molecular weight** is the mass of a molecule relative to an assigned mass of 12.00000 for C-12. Again, a more useful definition is

Definition of molecular weight.

Molecular weight is the sum of the atomic weights of all the atoms in a molecule. (3.2)

To determine the molecular weight of carbon tetrachloride, for example, we note that one molecule of CCl_4 consists of one C atom and four Cl atoms, and

molecular weight CCl_4 = at. wt. C + (4 × at. wt. Cl)

$$= 12.01 + (4 \times 35.45) = \mathbf{153.8}$$

Although we can always refer to the formula weight of a compound, the term *molecular weight* is valid only if discrete molecules of the compound exist. If the formula unit and a molecule are identical (as in CCl_4), the formula weight and the molecular weight are identical.

Mole of a Compound. We can apply the concept of a mole to any species—atoms, ions, formula units, molecules. Thus, we can describe a mole of a compound as an amount of the compound containing 6.02214×10^{23} formula units or molecules. We can also extend the term *molar mass* to moles of formula units or molecules, so that

Recall the meaning of the equivalence sign introduced in Section 1-9.

1 mol $MgCl_2$ ≎ 95.21 g $MgCl_2$ ≎ 6.022×10^{23} $MgCl_2$ formula units

and

1 mol CCl_4 ≎ 153.8 g CCl_4 ≎ 6.022×10^{23} CCl_4 molecules

Example 3-1

Using molar mass and the Avogadro constant to determine the total number of ions in a sample of ionic compound. **An analytical balance can detect a mass of 0.1 mg. What is the total number of ions present in this minimally detectable quantity of $MgCl_2$?**

Solution. **We use the molar mass to convert from mass to number of moles of $MgCl_2$. Then we follow with a conversion factor based on the Avogadro constant to convert from moles to number of formula units. Our final factor is based on the fact that there are *three* ions (*one* Mg^{2+} and *two* Cl^-) per formula unit (f.u.) of $MgCl_2$.**

Are You Wondering:

When to use 1.008 g/mol for the molar mass of hydrogen and when to use 2.016 g/mol?

The statement, "a mole of hydrogen" is ambiguous; you should always say either a mole of hydrogen *atoms* or a mole of hydrogen *molecules*. Better still write **1 mol H** or **1 mol H_2**. If you do this is, then you will see that the molar masses should be expressed as **1.008 g H/mol H** and **2.016 g H_2/mol H_2**. This distinction is very much like the distinction between one dozen socks and one dozen pairs of socks (that is, the H atom is analogous to a single sock and the H_2 molecule to a pair of socks).

TABLE 3-1
A Summary of Terms Used in Stoichiometry

Term[a]	Definition or usage
atomic weight standard	An atomic weight of 12.00000 is arbitrarily assigned to $^{12}_{6}C$.
isotopic mass (nuclidic mass)	The mass, in atomic mass units, u, of a single atom, on a scale in which the mass of an atom of $^{12}_{6}C$ is arbitrarily defined as 12.00000 u (e.g., $^{35}_{17}Cl$ has an isotopic mass of 34.968852 u).
atomic weight (relative atomic weight)	A dimensionless (pure) number that expresses the mass of the naturally occurring mixture of isotopes of an element, relative to an arbitrarily assigned atomic weight of 12.00000 for carbon-12. These are the values listed in a table of atomic weights (e.g., atomic weight of Cl = 35.4527).
formula weight (relative formula weight)	A dimensionless (pure) number that expresses the mass of a formula unit of a compound, relative to the atomic weight standard, carbon-12 (e.g., formula weight of NaCl = 58.44). Tabulated atomic weights are used in computing formula weights.
molecular weight (relative molecular weight)	A dimensionless (pure) number that compares the mass of a molecule to the atomic weight standard, carbon-12 (e.g., molecular weight of CCl_4 = 153.82). Tabulated atomic weights are used in computing molecular weights. Use of this term should be limited to situations where discrete, identifiable molecules actually exist.
mole	An amount of substance containing the same number of elementary units (6.02214×10^{23}) as there are $^{12}_{6}C$ atoms in 12.00000 g $^{12}_{6}C$.
molar mass, $\mathcal{M}$ (molar weight, mole weight)	The mass of one mole of a substance, whether the substance is composed of individual atoms (e.g., 35.45 g Cl/mol Cl), formula units (e.g., 58.44 g NaCl/mol NaCl), or molecules (e.g., 153.82 g CCl_4/mol CCl_4). Often the terms atomic, formula, or molecular weight are used, even though molar mass is what is intended.

[a] Wherever the term "weight" occurs, the term "mass" is equally (or even more) appropriate, e.g., atomic weight = atomic mass.